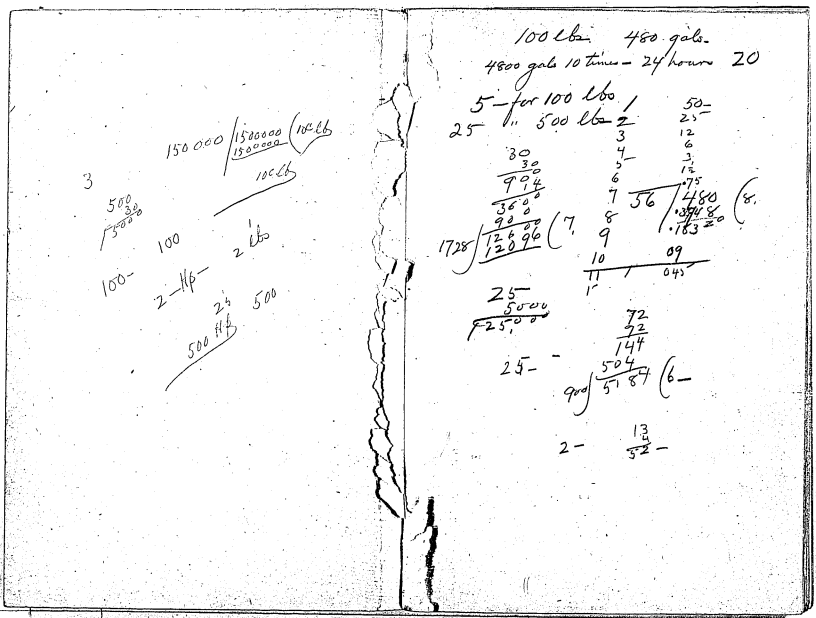
Notebook, N-01-05-10

This notebook covers the period May-June 1901. All entries are by Edison. The book contains notes and drawings relating to the development of Edison's alkaline storage battery. Included are preliminary sketches for a manufacturing plant, notes regarding the production of nickel suitable for use in the battery, and a list of experimental techniques for packing the nickel into the cell grids. The front cover is marked "May 01." The pages are unnumbered, and several pages have been removed from the book. Approximately 60 pages have been used.



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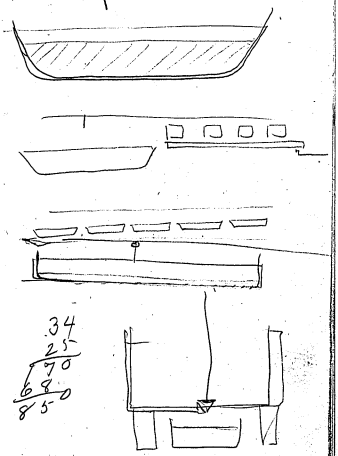
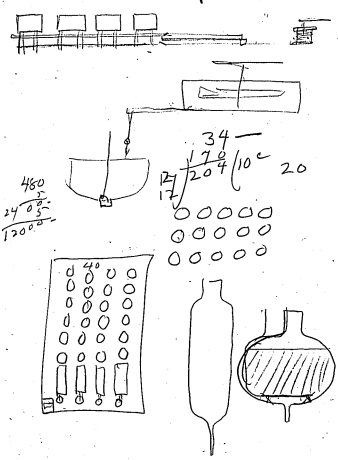
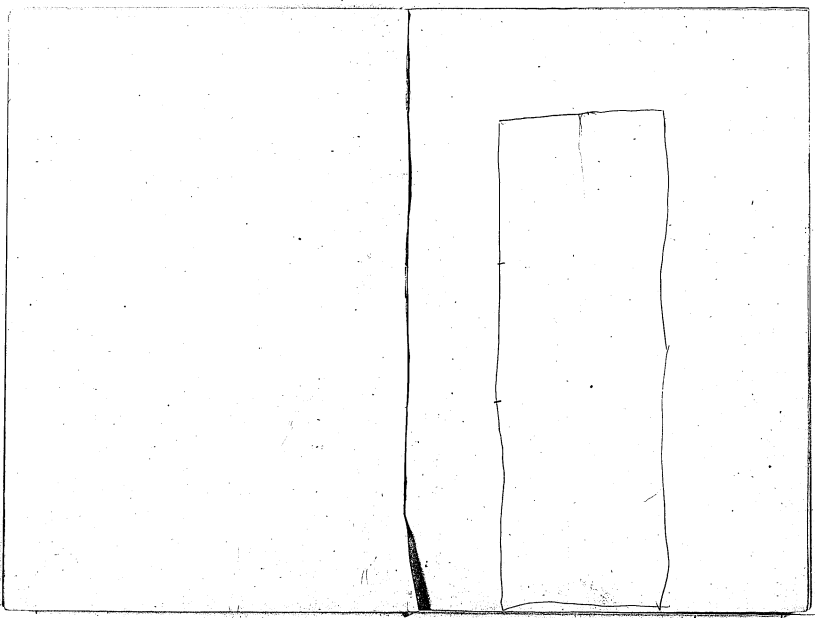
May 10 1901



34
25
70
68
85-0

May 10 1901

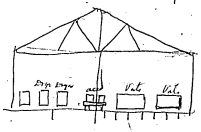




50 | 180 | 18 cents lb

500 | 5000 | 4

1000 —



45 c lbs 6 72

355

300 | 4200 (14

1000 | 10000 | 7

210 | 350 | 60

350 | 210

355 | 140

May 10 1901

300 lbs Sweet 50

50 x 200

50 x 100 250

50 x 3100 = 15 5

350

3000 — 21

1400

50 x 400

1 8000

180000 | 1440 | 3000 (21

2800

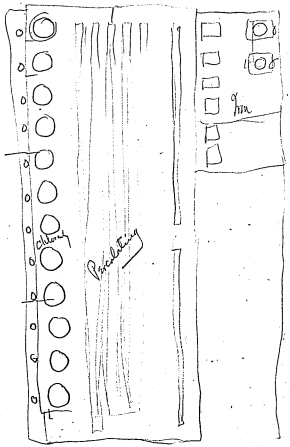
200

500 lbs hay 60

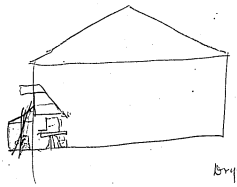
4 4 4 4 2 2 2 2 50

19

12 Inches



May 10 1901



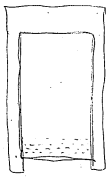
Boilers — 3 00
Kettle. 1 00
Dryers 3 50
plate
press
bags
pump

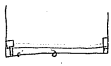
Bldgs 10 000
Foundts 1 000
Steam Jacket Kettles 1 000
Vats 1 000
Chilly tubs, 1 000
" Jacket. 1 000
Lightning — 1 000
Regularly Necessary 250

14 650
10 000
24 650

Iron 1 000
Rivets 3 00
Vats — 5 00
Etc 1 000 Edison
pump — 1 500
Well — 10 00

March 1901





24
4
164
108
1684
2680
2300
3800
3680
20

460 | 1684 | 3.65

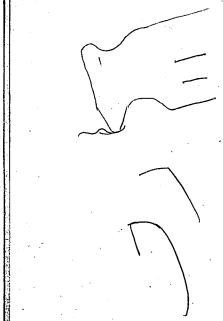
4.18
4
240
192
21.6

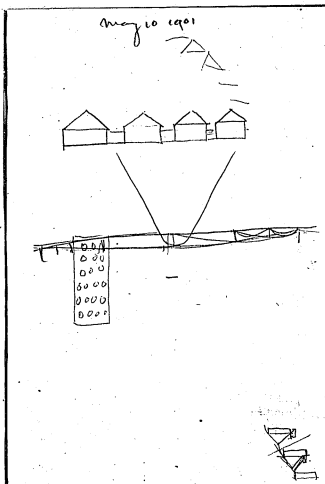
2.16 cents per call

10 | 4.4

9.50 cHpH

2.16
44
864
864
95.04




maggio 1901

May 24th 1901 —

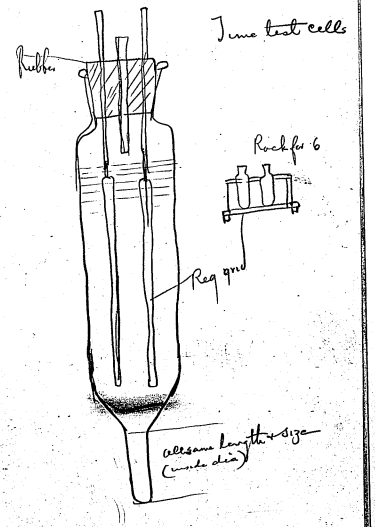
So far the experiments on making Ni O hydroxide shows that all the published processes produce in addition of the hydroxide, basic salts of the acid Rad of the Ni Salt used - and there is the greatest difficulty in making the pure hydroxide - so far Merck's Ni is purified by passing H_2S. then boiled + filtered, then treated for 2 days with Carb Barium - After filtration the Soluable Barium Carb is precip by H_2SO_4 - Soluble allowed to stand decanted + filtered, This soluble is treated while boiling to KOH freed from Carbonate by $Ba(OH)_2$ + boiled with excess KOH — Washed by decantation it settles well except fine 6 th

May 24 1901

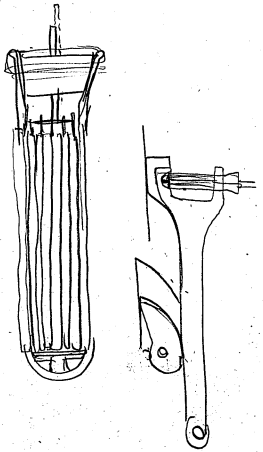
decantation then slowly - a few drops ammonia Causes it to settle OK —

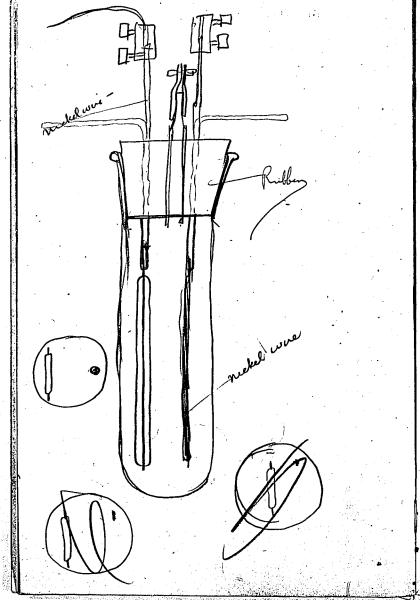
The other way is to take the Ni Nit boil + then to another solution boiling Caustic precipitated $Mg(OH)_2$ from the Nitrate by KOH - The Ni Nit is added to the proper amount leaving an excess of $Mg(OH)_2$ - To prevent basic salts of Ni from ~~from~~ ~~the~~ ~~precipitate~~ ~~was~~ ~~washed~~ by decantation & then fully Chlorinated to turn it to Ni_2O_3 - the $Mg(OH)_2$ turning to $Mg(ClO)_2$ which dissolves

May 24. 1901


Rubber
Jena test cells
Rack for 6
Reagent
about same length + size
(inside dia)

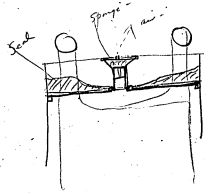
May 24 1901

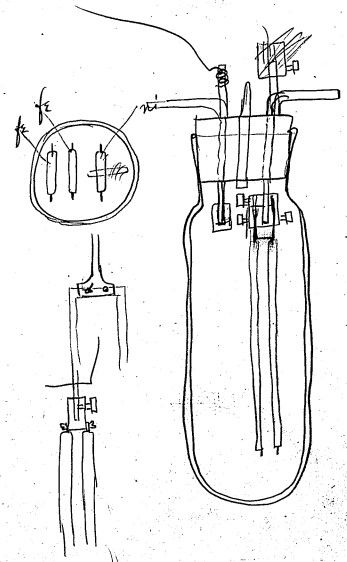


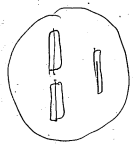


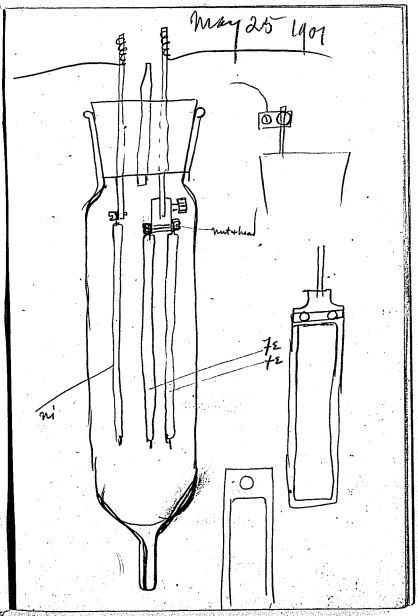
24 May 1901

Purpose to close cell keep out CO_2 by a rubber valve — also by a syringe nut with KOH or BaOH —








May 25 1907
Platinum
Pt
Pt
Pt

May 25 1907

Reduce Ni from Oxalate, Nitrate Etc by Hydrogen then pass —

One hour, Vapor phos —

2nd " PH

3rd " NH_3

4th " Arsthydgn —

5th " Co Nickel kept at heat to form Ni Carbonyl then Cool down + pass Co for

One hour

ditto same but after Co pass instead H for

One hours —

William Fallon

$22\overline{)162}\ (7\ 3$
154
8

$43\overline{)258}\ (6\ 5$
258
220
215

$35\overline{)224}\ (64$
210
140
140

$13\overline{)68}\ (5.2$
65
30

$22\overline{)132}\ (6$
132

$24\overline{)168}\ (6$
168

$16\overline{)90}\ (5.6$
80
100

$50\overline{)168}$
$3\ 16$

$19\overline{)112}\ (5\ 8$
95
170
152

June 1 1901 XX series

Experiments to determine best way to pack nickel & iron oxides — grid from 12 lb lot Seaton grease

1st = Limit pressure of die so edges are thrown over ok but pressure may be varied down to 5 atmos ~~gauge~~ what is equal to 5 at on gauge but 7½ atmos on Turning cup over on grid — All the pressure needed is to force burrs into brick & spread it. The overall will then be very little as it will take place internally =

2nd Make large grid or several small ones fill & charge fully then break take out whole & gently dry & make 2 grids together same way see if holds charge & cobalts again

3 = powder Ni & then polish grains with photographers pkgs. only polish them, then wash and water & roll -

4 = Have Acheson purify some of large size Graphite we can find every 5 mesh try 2 grids on this & 2 with 50% big 50% 30 on 50 - mixed.

5th = Try a good Rafn Fe with 8+2 7+3 6+4 5+5 -

6 ditto Ni with 6+4 5+5 4+6 graf 3 ni 7 graf 2 ni 8 gr to get a Curve

7 Silver plate by Cyanide some 30 m. 50 purified graphite use 6+4 H_2O + Roll -

8 Ditto Nickel plate purified graphite, lightly 6+4 H_2O + Roll

9 Try some magnesium powder with Ni 6+4 - H_2O + Roll -

10 = Make req Ni brick + moist outside + thick layer graphite on also moist inside cup + do same then press -

11 = Make Ni brick with 10/1000 pieces wet + pressed as brick no graphite –

---

12 = attack the surface of purified graf with Concentrated Nitric – or boiling $KClO_3 + H_2SO_4$ until get a dull surface – then make reg Ni 6+4 H_2O + roll –

13 = 7+3 Ni Ni worked to pulp in water + 1 part yellow ox Hg worked in after it is dried somewhat then H_2O + Roll –

---

14 = 6+3 Ni Reg with 60 Milgm oxide Silver worked in –

500 – 30000/3000 (60 milgms

15 6&3 Ni Reg with 1 part precipitated Copper Oxide worked in

---

16. 6&3 Ni with 1 gram Magnetite worked in Rather very fine ground

17 Briquette pressed Edgewise so graphite flakes will reach across + not float,

18 - Reg Ni - 5% KOH Cp closed 10% 15% 20% 25% 30 35 + 40% —

19 - Same with CP Sodium —

20 Same Lithia —

21 - Same BaOH Saturated

22 " Strontia OH "

23 = Aylsworth Make a CP Cobalt Hydroxide Wk req-

24 = Make briquette solid Ni OH + use bag graphite on outside + edges + plenty in Cups.

25 Make Ni bricks + then use 2 slabs of graphite same size as brick 005" thick put one Each side + press req way

26 = Dehydrate NiOH in Open at 150 212 + 250 — also in Closed tube 150 212 + 250

27 Dehydrate Ni in Boiling Glycerine

28 " in Chloride Zinc

29 " " " Calcium -

~~30 " " " KOH~~

30 " " " Castor Oil & afterwards boil out oil in weak KOH - & wash -

31 Rafn run Curve on Ox Ni from Oxalate - to get best results from H_2O -

32 Ni Oxalate heated to oxide then reduce it, then put in grid neg & oxidize in Strong $NaCO_3$ to peroxidize then wash in water & put in neg KOH,

33 = ~~graphite~~ plated in graphite, packed in grid + oxidized in Conc CO_3Na - by Ct

34 = See if a better oxidizer, than $NaCO_3$ Cannot be found for oxdz Metallic Ni to Ni_2O_3 or higher by Ct
Try - $KClO_3$ also $KClO_3$ in KOH

35 Try Chlorate of Nickel see ~~what~~ what works -

36 Reg Ni 644 but acheasons non flake graphite used

37 = Acheasons porous non flaky Graphite Soaked in Conc Nit Ni + precip by Soda in pores - washed, then dried + pressed in brickettes.

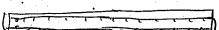
38 Make a lot of Ni_2O_3 by acting on green unbottom cell by current, Ni disk Electrode KOH – Wash & put in grid Reg way – use granulated not pulp –

39 = Try ignited good Conducting Lampblock with Ni & Reg 6 & 4 Ni –

40 = Lay a perforated piece in Center of briquette with Ni Reg

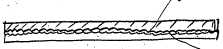
41 Lay a perforated piece in center of brick with one end a little long so it comes up at one end of Cup – will make Contact with Cup when pressed in grid –

42 Same as 41 but 2 pieces -



This will insure good Contact,

43 -



Make brick in 2 parts with 2 pieces inside this will let KOH in & Res will be 1/2 it will work ok when pressed in Cup as brick side is ok for the Cup burrs entering -

44 Try Acheson flake graphite with Ni -

45 - Have Asbury mfg. some Ceylon graf -

46 get some Electrolyte + put in ~~some~~ KOH solution + while shining pour in Hot Nickel ~~and~~ to precip together —

---

47 Make ½ doz 003 cups of nickel + test 12 lb green hat in —

---

48 Roll some Steel to 1/1000 + make some Cups Nickel plate thin + test with Rey —

---

49 = Purify some KOH free acid radicals or Halogens + test in closed cell.

50 - Reg big bat when Wednesday & before drying thoroughly ~~mix~~ mix the graphite in right proportions & dry & roll before dead dry -

51 - See if its possible to Commercially make an amine which is an alkali to replace KOH - see Myers book -

52 Nov XX Solder 10 joints & place in KOH Make a Post & Neg & spark both - put date on. Arrange a line in Case to put time tests on so they not be disturbed

June 2nd 1901

53 - Put a good Fe reducing
in time test line with oxdzg

54 = Try very thin 1/4/1000 mm scale
to mix with powdered Fe - also try
with Ni - no graphite - also some reduced
by H ? ?.

55 also try rolling out magnesium powder
to a scale -

56 - Try Copper scale very thin instead of
graphite, to mix with Fe + also Ni -
also very thin reduced in H ? ? -

57 = precip Ni sulphide see if Conducts
if so try it in grid if it don't oxidize
up or reduce Mix with Ni -

58 = Try & can form a sulphide scale on sheet nickel & see if it is not too brittle, so can use it for mixing —

59 = Make very thin 7x scale reduced by H by Rafnas heat Cuno & use it alone in grid —

60 Anneal a file & see how it works —

61 - Ask Malley to get from Bethlehem a pound or 2 of nickel steel, or from Shelby a piece of Ni steel heat quickly —

62 = Try in grid to absorb O.
Sulphate Ba, Oxalate Lime
Phos Magnesia & other insoluble salts —

63 = Make grid Barium Chromate
6 graphite 4 - use Iron
+ Saturated Solution of
Barium Hydroxide -

64 = Bismuth Hydroxide made
by KOH + BiCl - to oxdyz +
test for deplyz -

65 = Titanium powder Dehlein -
to 1st deox then acc Ct then
ox + use Fe -

66 Molybdenum
details as with 65 -

[JUNE 7, 1901?]

May 7 1901

67 Ironed by H 800 - from Oxalate - Fe treated partially by perox hydrogen - and dried - 842

68 = Iron from oxalate red by Hydrogen 800 — acted on by Hypo — washed - air dried 842
1st 1277 2nd 1282 - 3rd 1137

69 = Iron from Oxalate reded with H 800 — acted on by boiling strong KOH washed air dried 842
1st 1350 2nd 1070 - 3rd 910 -

70 - Aylesworth Big Lot Cp - dried then put in KOH + Bromine added turns to olive reddish - 604 -

71 = Oxol 72 reduced by H 608 - acted on 2 hours H_2O_2 only formed little Oxl acid very slight amount then little more H_2O_2 it then swelled greatly Washed only four - 1st 350 2nd 332

682

oxdyzes to red on air Cat slowly -

72 Oxnl Fe reduced by H
then put in water with
very little KOH + per
ox hydgn added it kept
black after about 2
hours added very
little H_2SO_4 + H_2O_2
it Browned rapidly +
dewelled to twice bulk
settles beautifully +
resembles ~~[illegible]~~ Ox from
FeS by Oxdy with Current
to Chocolate Color wet
842

73 = Ferrous Sulphate
treated with formalde-
Hydrogen in excess - soon
throws down a precipitate
(washed well -
842

74 = Otl No 140 is Blue Cupric
hydroxide - made grids -
orig'd by Cummit showed
Very poor ? scarcely anything

75 = 9s Oxalate Fe ignited & reduced at Red to Metallic iron — Treated with a little peroxide Hydrogen — considerably more than 76 which is only 20 or 30 drops to 6 or 8 grammes 842 = just off dead black 632 mah

76 = Same as 75 but very little peroxide Hydrogen used — 842 — no brown but dead black 1232 mah 1st

77 = 9s same as 75 but treated with a large quantity peroxide turns brown — 842 = 2265 mah

78 = Nickel reduced by H or it is
Oxalate heated in air till it
got black Ref. not ours exhibit
Then was black when I got it
Been treating it for 3 days
on alcan bath with Hypo
644 — ng nothing at all

79 — 67 gwa — 6 parts powder
fuse, then 4 grammine photo
flour 6 to go shaken in bottle
then rolled dry — Then 1.5 grms
flake graf 30 to 50 Reg. then
mixed + rolled dry — it completely
Covers green 110 + Cakes dry
This makes 6 N.O 4 graphite —

1st 302 wet Dry 32 —

Weak

80 — Iron from Oxalate reduced to metal by Hydrogen treated with 2 inches in test tube of H. ppt & 4 times as much water, in liquid 20 hours — 8+2

81 — Same as 80 with Stronger Solution Hypo — 8+2

82 Same as 80 with very Strong Solution Hypo 8+2

83. #067 Nickel ppts - 6 parts graphite through 8 mesh on 12 mesh not purified #20 - Mont Rolled —

84 = Thin is Riefus Iron reduced by Hydrogen at good red heat, treated many times with Hypo on Steam table 30 hours — its gray + no tint of Brown its bulk has considerably increased & found to differ from #080 3rd one which gave 1950 Wah -

88 = #067 put in Reg 6 & 4 then dipped in Strong ammonia & soaked as long as no color comes out

85 Nickel reduced by H at red heat - [redacted] HCl - little white ppt ½ hour then Hypo 12 hours - ng -

86 - Nickel reduced not quite red heat 1st lot, No HCl - Hypo 30 hours - ng

87 Nickel Red heat by H Chlorate K + HCl - ½ hour then washed, then Hypo all night — ng

Hopper No 1

		Flow
Crude	65.17 72	.014
Conc	67.66	010

Hopper No 2

Crude	38.61	.414
Conc	56 48	.191

Hopper No 3

Crude	35 38	.240
Conc	61 45	.090

Osborne Mer

Crude	25 70	.337
Conc	58 35	.268

89 Salad MO_2H_2 No 67, no graphite — H_2O wet, 1st 115 2nd 149 (Small 149)

90 — 6 parts No 67 gva — 1 part powdered ~~Bicarbonate~~ Carbonate Soda 3 parts graphite, H_2O —

91 = No 67 gva ground (wet) and dehydrated at 212 for 1 hour in water bath 644 1st 557 2nd 600

92 No 67 gva 644 — This and 90 to 62 gva went to Roxbr. to Nickel plate over the cobalt

93— No67 gwa— 6 parts
3 parts grafite + one part
Carbonate ammonia — mix
dry ——— heat in oven
Bath ½ hour ———
1st 400 2nd 632

94— No 67 gwa 6 parts
3 parts grafite ~~two~~ parts
Camphor— Roll— wet with
Water, 1st 330— 2nd 525

95 = No 67 gwa 5 parts
3 parts grafite 2 parts
Camphor — wet with water
+ Roll—

June 26 1901

96 6 parts Sulphate of Lead 4 parts graphite — Zinc Electrode

~~Dipped~~

Both are to 6z put in plain water and ~~dipped~~ with 3% of Nitrate Zinc discharged ← charged several times —

98 = 6 parts precipitated Peroxide of Manganese (Wz Home made) 4 parts graphite —

This is to 6z put into a 20 per Cent Solution of Chloride of Ammonium with a Zinc Electrode — and discharged ← Recharged —

99 — 6 parts Chloride Silver 4 graphite use in 3 per cent solution of Chloride of Zinc + Use Zinc El

June 29, 1901

100 6 phosphate Lead 4 graphite — ditto —

101 Both affected and to be put in solution of 5% of phosphoric acid — at 6 hrs. discharged 100 Positive 101 Neg —

102 6 grains Borate Lead 4 graphite Make 2 grids both put in 5% Solution of Boric acid in water — Pos Neg —

103 6 grains Tungstate Lead (obtained by precipitation) 4 graphite — Make two electrodes put in Solution of 10% Metatungstic acid — Charge & discharge

104 6 parts finely powdered Native peroxide Manganese Pyrusolite good quality from selected lumps finely powdered 4 parts graphite —

~~[illegible]~~ strong solution Chloride Ammonia 20% — discharge + then recharge

103 — 70 gms - 6+4 use water after putting in grid bake for hour on oleum bath to get water out

104 Duplicate of 103

105 65B gwa 6+4 ground very fine
+ rolled + rerolled 5 or 6 times more
than usual use Dabz water
than usual to stain with.

106 Dup of 105

107 – 65B gwa 6+4 ground very fine,
then put in water + floated, ~~then~~
stuff not floated re-ground + so
on until the whale is float,
rafft a great deal —

108 Dup of 107

109 - 65-B gpw a 6+4 - Done in the regular way + to 62 run in 40% KOH + treated in 40% KOH — Become + test the Corps about the 40%

110 Dupe of 109

111 — 65-B gpw a 6+4 done in the regular way

112 Dupe of 114 ———

113 — 6 of Nickel 2 of graphite 2 parts Carbonate Ammonia - Bake grid on steam bath ½ hr. Swell 180 — good swell loose volts 514 — to 935 on 118 cycles

114 Dupe of 113 ——— Not so good swell Swell 129 3rd Rise

113. bottom jar has white sediment thus shows Carb NH not all driven off —

115 6 nickel 3 graphite. 1 Carbonate. ammonia heat grid on steam bath ½ hour —

116 - Dup of 115 —

117 - 6 of Zinc dust 4 graphite — to be put in a saturated solution of Aluminate of Potash - with a charged Nickel Electrode & discharged

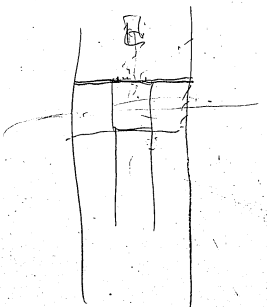
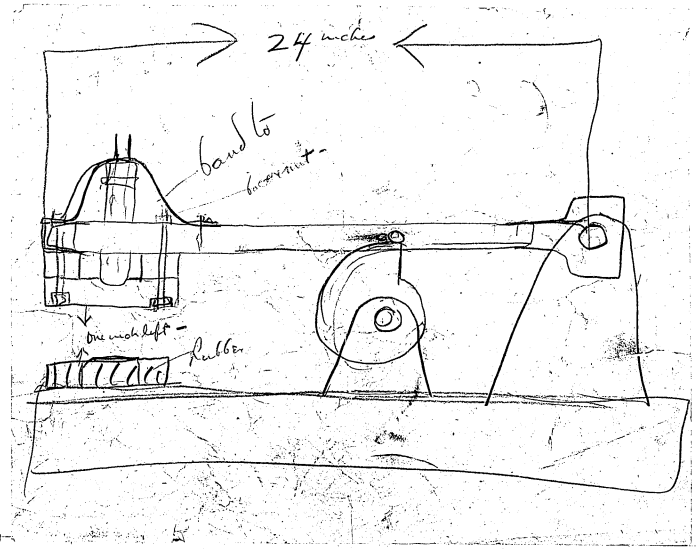
118 - partially dried Nickel Hydrate 8 parts Nickel 4 parts graphite NO water. Roll well as too wet Roll rolled stuff dry a little till its OK —

119 Mercurous sulphate 6 parts
4 parts graphite water

120 Duplicate of 119

121 6 parts manganese hydrate by treating suspended Carbonate with Chlorine
4 parts graphite

122 Cu.O by roasting Carbonate at red heat
(Reporting Imagers Report)
Cu.O 6 parts graphite 4 parts



[ITEM FOUND IN BOOK]